

METHOD AND DEVICE FOR MEASURING THIN FILMS
AND SEMICONDUCTOR SUBSTRATES

Abstract

The invention provides both a method and apparatus that measures a property of a structure that includes at least one layer. The apparatus features a laser (e.g., a microchip laser, described below) that generates an optical pulse, and a diffractive mask that receives the optical pulse and diffracts it to generate at least two excitation pulses. An optical system, (e.g., an achromat lens pair) receives the optical pulses and spatially and temporally overlaps them on or in the structure to form an excitation pattern that launches an acoustic wave. The acoustic wave modulates a property of the structure, e.g., it generates a time-dependent "surface ripple" or modulates an optical property such as the sample's refractive index or absorption coefficient. Surface ripple is defined as a time-dependent change in the morphology of the surface; its peak-to-null amplitude is typically a few angstroms or less. The apparatus also includes a light source that produces a probe beam that reflects off the modulated property to generate a signal beam. An optical detection system receives the reflected signal beam and in response generates a light-induced electrical signal. An analyzer analyzes the signal to measure the property of the structure.

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